A KNOWLEDGE-ENABLED PROCEDURE FOR CUSTOMER RELATIONSHIP MANAGEMENT

Rajat Goel
Department of Management, Chandigarh University, Punjab, India

Abstract
The value of knowledge management and customer relationship management is well recognized by many leading companies. This study presents a proposed model of Knowledge-enabled Customer Relationship Management and demonstrates the way in which the presented model can facilitate the identification of important factors that have key impacts on business performance in particular settings. The results show that employees in the steel industry indicate that to provide product and service information for customers and to share internally the best practice information can have benefits for hard measures such as market share, repeat purchases, and customer retention and for soft measures such as customer satisfaction, market leadership and customer loyalty. Employees in the textile industry report that to provide customercomplaintinformationofcustomersandtoshareinternallythebestpracticeinformationcanhavebenefitsforhardmeasuressuchas customer retention, cost savings, and market share and for soft measures such as customer satisfaction, market leadership, customer loyalty, and customer and employeeproductivity.

Keywords: Knowledge management (KM); Customer relationship management (CRM); e-Business

Introduction

Recently, several leading companies have taken advantage of the power of CRM to expand their markets sharply. These companies established CRM systems to maintain and further create loyal customers. Formulating CRM strategies can also create valuable marketing opportunities, increase customer value and enhance customer satisfaction in the pursuit of business excellence (Lin & Su, 2003). Unfortunately, most companies have limited knowledge about CRM and ignore its importance. It is common sense that the loss of a good opportunity to serve customers better could create a great opportunity for competitors to increase their market share. To respond successfully to increasingly competitive environments, companies must examine how they can better leverage knowledge assets and create added value. KM sees the knowledge available to a company as a major success factor. Davenport and Prusak (1998) have emphasized that KM addresses the issues of creating, capturing, and trans- ferring knowledge-based sources. Both CRM and KM approaches can have a positive impact on reducing costs and increasing revenue.

Apollo I (a fictitious name for the case) is a steel company founded in the 1980s in Southern Taiwan. It has about 1500 employees and its capital exceeds 30 billion NT dollars. It has the first integrated stainless steel mill in Taiwan, which consists of a steel melting operation with a hot rolling mill and a cold rolling plant. The integrated stainless steel mill is also the largest in Southeast Asia. Apollo produces high purity, high quality stainless steel in many shapes and sizes and a large variety of stainless steel products. Each process and product is monitored by a computerized system to give strict quality control. Apollo has about 5% of the market share of stainless steel products in the world. It offers customized products and a variety of technical supports for its customers. It also has a complete internal management information system and software, which should make its electronic connection with its customers easier in the future. In 2001, the authors were invited to do the planning for the computerization for Apollo I and its customers.

Apollo II (a fictitious name for the case) is a textile company that was established in Southern Taiwan in 1972. Globally, it has about 2000 employees in its mills in Taiwan, Germany, Hong Kong and Shanghai. The major products include dyed-yarn, filament fabric, decorative fabric, and home textiles. It has a gingham factory and a filament weaving factory producing dyed-yarn fabric (4,500,500 yd/month) and filament fabric (3,500,000 yd/month). In addition, it operates its e-data business over the Internet for aspects of its supply chain and sales. Its products receive intensive production and quality management, so it can satisfy customers' needs efficiently and flexibly. The authors have been consultants for Apollo II's e-marketing planning since 2002.

The improvement of customer relationships through KMcan generate great business opportunities. Taking the steel and the textile industries as examples, this study performs a comparative study between these two industries and explores the following three interrelated objectives:

1) Present the proposed KCRM model which facilitates the exploration of the relationship among the three dimensions of customer knowledge sources, customer knowledge management and customer knowledge performance measurement;
2) Conduct a comparative study of the case companies in the steel and textile industries in terms of the presented model; and
3) Show the way in which the presented model can facilitate the identification of important factors that have key impacts on business performance in particular settings.

Literature review

Customer relationship management

As the business world has shifted from product focus to customer focus, managers have found that the enhancement of existing customer relations brings the benefit of profitable and sustainable revenue growth. CRM enables a business to understand better the stated, and especially the implied, requirements of its customers. Pepper, Roger, and Dorf (1999) have focused on four steps (identify, differentiate, interact and customize) for one-to-one marketing. Brown (2000) presented the strategic customer care 5 pillar model to build a CRM model for enterprises. Handen(2000)considered that five dimensions (strategy, organization, technology, segmentation and process) are necessary to implement a CRM project effectively. Curry and Curry (2000) have written a clear, step-by-step guide about how to profit from CRM, with strategies that are aimed at small and medium-sized business owners. Dyche (2002) provided guidance for an enterprise to adopt and implement its own CRM solution. Williams (1970) emphasized that all other aspects of strategy are wasted if you don't target the right customers. So it is very important to build the right customer portfolio. Cole and Goldsmith (1997) have offered a good recommendation which is to select the right range of value proposition. Wayland and Cole (1997) have presented the value compass model that facilitates electronic data exchange between what managers know about their customers and how they can leverage that information to create greater customer value.

Formulating CRM strategies can also create valuable marketing opportunities, increase customer value and enhance customer satisfaction in the pursuit of business excellence (Lin & Su, 2003). In our previous paper (Lin & Su, 2003), the value compass model from Wayland and Cole (1997) was revised to enable the strategic analysis of CRM. This paper extends the previous paper in order to understand the process of KCRM to see how KM can help CRM implementation.

Knowledge management

Knowledge is defined as information that is relevant, actionable, and based at least partially on experience in a business context (Leonard &Sensiper 1998). It is an emerging field that has commanded attention and support from the industrial community. Many organizations currently engage in knowledge management in order to leverage knowledge both within their organization and externally with shareholders and customers. A number of individuals and organizations have developed frameworks for knowledge management. In essence, they prescribe different ways to engage in knowledge management activities.

A KM strategy can help tear down traditional cross- functional boundaries. KM entails helping people share and put knowledge into action by creating access, context, infrastructure, and simultaneously reducing learning cycles (Davenport, Delong, & Beers 1998; Davenport &Prusak 1998; O'Dell & Grayson 1998). Popular press reports, conferences, books, the growing number of CRM and KM systems, vendors, and consultants, all indicate a surge in interest and emphasis on both CRM and the management of organizational knowledge.

Knowledge-enabled Customer Relationship Management

Tiwana (2000) defined Knowledge-enabled Customer Relationship Management (KCRM) as ''managing customerknowledge to generate value-creating lock-ins and channel knowledge to strengthen relationships and collaborative effectiveness, knowledge-enabled CRM is more of a businessmodel/strategythana technology-focusedsolution.'' He clearly highlighted the importance of knowledge management and customer relationship management for every business decision-maker and IT professional. The availability of large volumes of data on customers, made possible by new technology tools, has created opportunities as well as challenges for businesses to leverage the data and gain competitive advantage. Arthur Andersen business Consulting (1999) indicated that the customer knowledge base is one of the top

ten most important contributors to KM. Lesser, Mundel&Wiecha(2000) have identified four approaches (customer knowledge development dialogues, customer knowledge communities, facilitating the capture of knowledge relevant data, and demonstrating enterprise leadership commitment to customer knowledge) that can expand the availability and use of customer knowledge. Lin (2000/2001) presented a systemic integrated communications model that may help enterprises identify the potential issues of CRM. Shaw Subramaniam, Tan, and Welge(2001) have presented a systematic methodology that uses data mining and knowledge management techniques to manage the marketing knowledge and support marketing decisions. Massey, MotoyaWeiss, and Holcom (2001) have explored the leading company IBM's first effort to re-engineer the CRM process by leveraging technology and its knowledge-based sources. Moreover, enabling CRM through KM inside IBM represented a full-fledged business approach to the acquisition, assembly, and application of knowledge to the CRM process. As shown from these researches, directly related to and underlying CRM is the emerging discipline of KM. Although a surge in emphasis and interest in both CRM and KM is indicated by popular press reports, books, conferences, the growing number of CRM and KM systems, vendors, consultants and so on,
CRM together with knowledge management (KM) still deserve further study.

Customer knowledge sources

The importance of KM was highlighted by Armbrechtet al. (2001) who put forward the FSimplified Linear Model of R&D_ which identifies that the process of KM is to source from tacit/explicit and internal/external knowledge, to generate ideas and make decisions from the steps of filtering, focusing and expanding, to take actions, and to feed back the results of actions taken to the source of knowledge.
Swift (2001) proposed the FCustomer Process Cycle Model_ which can accumulate customer knowledge and improve the learning of CRM through the four steps of Knowledge Discovery, Market Planning, Customer Inter- action and Analysis and Refinement. In terms of information collection, Tiwana's(2000) FCustomer KnowledgeSource_ also offers valuable guidance. Therefore, this paper adopts Tiwana'sFCustomer Knowledge Source_ as part of the research design.

Customer knowledge management

Peter Drucker speaks of knowledge as ''the most important resourceof the 21th century.'' Davenport and Prusak (1998) have shown that it is important to know how to collect, store, and distribute useful knowledge. The CRM process can be considered as a knowledge-oriented process with the characteristics of knowledge intensity and process complexity.
Alajoutsija¨rvi, Klint, and Tikkaner(2001)have argued that through maintaining a consistent and permanently cooperative relationship with profitable customers, a business can considerably reduce the fluctuations of price and demand in its business cycles and stabilize its environment in the long run.
Comparing the CRM models of the early 1990s with present models, the former have a smaller scope of application than the latter, especially in the application of information technology. Korner and Zimmmermann (2000) proposed the FManagement of Customer Relationship in Business Media Model_ (MCR-BM) which addresses the five dimensions of Customer Interaction, Virtual Comunities, Trust, Value Added and Customer Profiling and two internal organizational management mechanisms, Process and Control, to improve the effectiveness and efficiency of CRM.
Bauer, Grether, and Leach (2002) have argued that the interactive nature of the Internet and its ability to constantly provide information can contribute to relationship marketing. Broadvision Consulting (2000) indicated that there were six steps to implement one-to-one CRM over the Internet:
(1) Ask customers what they want
(2) Tell customers what we have got
(3) Give customers what they want
(4) Allow customers to perform FDo It by Yourself_ (DIY)
(5) Understand customers' preferences
(6) Remember customers' preferences; these steps can be recursive by going back to step 1 after implementing step 6. However, businesses will be confronted with many challenges when evolving from CRM to e-CRM.
Pritchard and Cantor (2000) have suggested that there are six challenges and objectives when planning e-CRM: Technology, Consistency, Balance, Change Management, Customer Expectation and Legacy Customer Care Environment.

Tiwana (2000) argued that the formation of the customer value chain will be influenced by all the

processes and therefore the objective of process planning   is to enhance the value delivered to customers in order to fulfill their expectations and to increase their loyalty. Therefore, this study explores the way in which customer knowledge management can help businesses collect customer knowledge and further influence customer knowledge performance.

Customer knowledge performance measurement

Avlonitis and Gounaris (1997) have pointed out that in addition to the emphasis on the establishment of a system of beliefs in marketing orientation within a business, a business' ability to gather customers' related knowledge such as their needs plays a vital role in becoming really marketing- oriented and achieving better performance. The hard andsoft measures examples from Tiwana(2000) can serve as the indicators of the business impact of customer knowledge management.

Research design and method

Research design

Because of the potential importance of enabling CRM through KM, this paper aims to present a model based onKCRM and to explore the relationship among customer knowledge sources, customer knowledge management and customer knowledge performance measurement (see Fig. 1). The steel industry and the textile industry are the focus of the research. Collection of both primary quantitative and qualitative data is necessary as there is no existing directly relevant data (to satisfy Objective 2), particularly from leading companies in two different industries in the twenty- first century. Case study research and a structured questionnaire survey are adopted as the research method. The structured questionnaire survey is adopted because this is the most appropriate way to collect relevant primary data from a high proportion of the marketing people in two busy leading companies for analyzing the expressed relatedness among the three dimensions of the proposed KCRM model as reported by the respondents in these two case companies in two different industries. Qualitative in-depth interviews with some staff from each company are used to augment and check the validity of the questionnaire findings. The collected data is further utilized to analyze the expressed differences between the case companies in the two industries in terms of the presented model, and to analyze for the identification of important factors as reported by the respondents to have key impacts on business performance in their settings

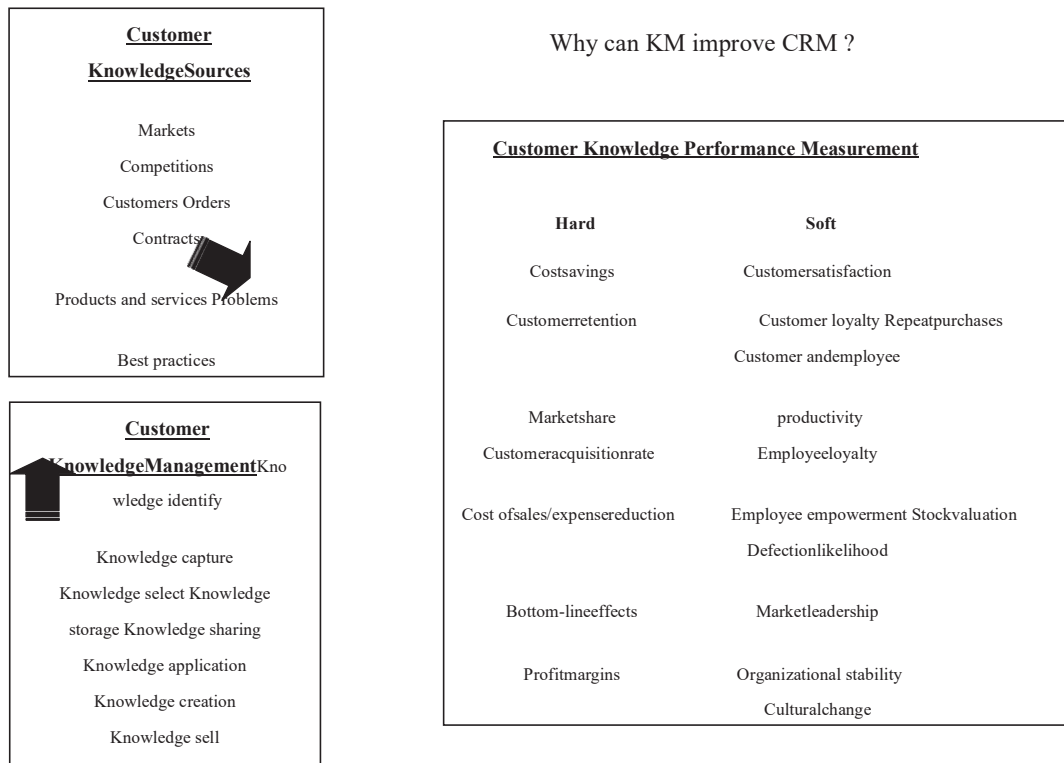What kind of customer knowledge sources does a company really need?

Customer KnowledgeSources	Why can KM improve CRM ?
Markets	
Competitions	**Customer Knowledge Performance Measurement**
Customers Orders	
Contracts	**Hard** / **Soft**
Products and services Problems	Costsavings / Customersatisfaction
Best practices	Customerretention / Customer loyalty Repeatpurchases
	Customer andemployee
Customer KnowledgeManagement Kno wledge identify	Marketshare / productivity
Knowledge capture	Customeracquisitionrate / Employeeloyalty
Knowledge select Knowledge storage Knowledge sharing	Cost ofsales/expensereduction / Employee empowerment Stockvaluation
Knowledge application	Defectionlikelihood
Knowledge creation	Bottom-lineeffects / Marketleadership
Knowledge sell	Profitmargins / Organizational stability
	Culturalchange

Fig. 1. The proposed KCRM model.

How KM can help collect customer knowledge source and furtherhighlightcustomer knowledgeperformance?

Collected data is further utilized to analyze the expressed differences between the case companies in the two industries in terms of the presented model, and to analyze for the identification of important factors as reported by the respondents to have key impacts on business performance in their settings.

Tiwana(2000) provided knowledge sources and categories such as markets, competitions, customers, orders, contracts, products and services, problems and best practices. Basically, knowledge about these sources and categories must be integrated into a knowledge-enabled CRM strategy.

Beckman (1997) identified 8 steps of KM: knowledge identify, knowledge capture, knowledge select, knowledge storage, knowledge sharing, knowledge application, knowledge creation and knowledge sell. As mentioned earlier (see Table 1), this study adopts Tiwana's(2000) suggestions to obtain hard and soft customer knowledge performance measurements. This study took advice from 10 senior managers in the steel and the textile industries and keep variables for each dimension as follows: markets, customers, orders, products and services, problems and best practices information for customer knowledge sources dimension; knowledge select, knowledge capture, knowledge sharing, knowledge creation and knowledge storage for customer knowledge management dimension; cost savings, customer retention, repeat purchases, market share, customer acquisition rate, cost of sales/expense reduction, stock valuation, profit margins, customer satisfaction, customer loyalty, customer and employee productivity, employee loyalty, market leadership, organizational stability, and cultural change for customer knowledge performance measurement dimension.

Table 1
Hard and soft measures (Tiwana, 2000)

Hard	Soft
Costsavings	Customersatisfaction
Customerretention	Customerloyalty
Repeatpurchases	Customer and employeeproductivity
Marketshare	Employee loyalty
Customeracquisitionrate	Employee empowerment
Cost ofsales/expensereduction	Defection likelihood
Stockvaluation	Marketleadership
Bottom-lineeffects	Organizationalstability
Profitmargins	Culturalchange

Sampling

This field study focused on two leading steel and textile companies (as mentioned earlier). Forty seven questionnaires were sent to the employees in the marketing department of the steel company and 40 questionnaires were sent to the textile company. Eighty seven responses were received from these 87 mailed questionnaires. As shown in Table 2, the response rate was 100%.

Table 2
Questionnaire response rate of the research

Sampling	Number of samples	Number of responses	Response rate(%)
Steel industry	47	47	100%
Textile industry	40	40	100%

Statistical analysismethod

The SPSS software package is used for data analysis in the study. The data analysis methods are as follows.

- Descriptive statistics

For individual variable or factor, descriptive statistics are used to describe the mean, variance and the categories and characteristics of data.

- Reliability and validity analysis

The value of Cronbach'saand Item to Total correlation are adopted to examine the internal consistency and reliability of all factors. For high reliability, the value of Cronbach'sashould be greater than 0.7; reliability is low if its value is less than 0.3. For high reliability, the value of Item to Total correlation should be greater than 0.6; reliability is low if its value is less than 0.3.

This paper actually focuses on customer knowledge management, so the responses from the marketing department are the most appropriate samples. In practice, the proposed KCRM model is designed for employees in the marketing department to enhance CRM through KM. These 87 respondents are representative with regard to internal validity (the total number of staff in the marketing departments of the two companies was about 90, therefore effective response rate= 96%).

With regard to external validity, these two case companies are leading companies in the Asia-Pacific area and have customers all over the world. Moreover, the development of Electronic Commerce (EC) is still in its infancy but these two companies are advanced in the EC area. This highlights the value of this paper.

- Analysis of variance

To understand the differences between the dimensions of customer knowledge sources, customer knowledge management and customer knowledge performance measurement and to discuss the differences between these dimensions in different industries, this study uses the General Linear Model to perform analysis of variance.

- Analysis of regression

To explore the effects of the dimensions of customer knowledge sources and customer knowledge management on the dimension of customer knowledge performance measurement in the steel industry or in the textile industry, this paper takes the latter as the independent variable and the former as the independent variables.

Research findings

Descriptive statistics of the threedimensions

- Analysis of the description statistic of customer knowledge source

The authors did interviews with some managers and employees in these two case companies after the questionnaire survey to verify the findings of the study. They agreed with the findings presented to them and their comments on some of the findings are also included below. In the dimension of customer knowledge sources, the mean value of the factor is more than 5 and between 5.11 and 5.61. As shown in Table 3, these two industries both reported that good customer knowledge source is good for product and service information, customer complaint information and best practice information.

- Analysis of the description statistic of customer knowledge management

In the dimension of customer knowledge management, the mean value of the factor is more than 4.5 and between 4.36 and 4.62. As shown in Table 4, these two industries reported that good customer knowledge management is good for knowledge storage, knowledge sharing, knowledge application and knowledge creation.

Reliability analysis

As mentioned above, the analysis of scale reliability in the study is performed using the Item to Total correlation, Cronbach's a coefficient and the cluster effects among variables. The greater the value of Cronbach's a, the higher the reliability is. Our research recognized that the value of Cronbach'sa should be greater than 0.6; at least its value should not be less than 0.35. Additionally, the value of Item to Total correlation should be greater than 0.6; at least its value should not be less than 0.35. The analysis of internal consistency is described below.

● Customer knowledge sources

In the dimension of customer knowledge sources, the value of Cronbach's a of the factor of Fcompetitor's information_ is less than 0.6 and the other factors' Cronbach's a values are all greater than 0.6. The Item to

Table 3
The mean of customer knowledge sources

Factor	Mean
Marketinformation	5.11
Customerinformation	5.36
Orderinformation	5.33
Product andserviceinformation	*5.48
Customercomplaintinformation	*5.41
Bestpracticeinformation	*5.61

*Importance

Table 4
The mean of customer knowledge management

Factor	Mean
Knowledgecapture	4.36
Knowledgestorage	*4.56
Knowledgesharing	*4.56
Knowledgeapplication	*4.60
Knowledgecreation	*4.62

*Importance.

Total correlation values of all factors are greater than 0.35. This shows that they are internally consistent. Because the value of Cronbach's a of the factor of Fcompetitor's information_ is less than 0.6, it is not discussed in the analysis of variance.

● Customer knowledge management

In the dimension of customer knowledge management, the value of Cronbach's a of the factor of Fknowledge select is less than 0.6 and the other factors' Cronbach's a value are all greater than 0.6. Except the values of two questions, the Item to Total correlation values of all other factors are all greater than 0.35. This shows that they are internally consistent.

● Customer knowledge performance measurement

In the dimension of customer knowledge performance measurement, the value of Cronbach'sa of the factors of Fhard knowledge performance measurement and Fsoft knowledge performance measurement are 0.8651 and 0.9148 respectively. Their values of Item to Total correlation are all greater than 0.35. This shows that they are highly internally consistent.

Analysis of variance

ANOVA is used in the research to examine the differences between the textile and the steel industries regarding the three dimensions of customer knowledge sources, customer knowledge management and customer knowledge performance measurement and their constitutive factors. The result of the analysis is shown below.

● The differences in customer knowledge sources between the steel and the textileindustries

As shown in Table 5, it's more important for the steel industry to collect best practice information and customer complaint information, whereas the textile industry feels it needs to collect best practice information and product and service information. Basically, each company has different requirements that should be found out case by case. In the dimension of customer knowledge sources, the expressed importance of the three factors of Fmarket information, Fcustomer information and Fcustomer complaint

information are significantly different between the steel and the textile industries. The steel industry putsmore stress on market trends, customer sales information and solving problems raised by customer complaints than the textile industry. The expressed importance of the factors of Forderinformation, Fproduct and service information and Fbest practice information, however, is not significantly different between these two industries.

- The differences in customer knowledge management between the steel and the textile industries

As shown below in Table 6, it's more important for the steel industry to focus on knowledge sharing and creation, while the textile industry prefers to concentrate on knowledge sharing and creation. Again, each company has a different position that needs to be found out case by case.In the dimension of customer knowledge management, the expressed importance of the five factors Fknowledge capture, Fknowledge storage, Fknowledge sharing, Fknowledge application and Fknowledge creation is significantly different in the steel and the textile industries. The steel industry puts more emphasis on these five factors than the textile industry. Concerning the factor Fknowledge capture, the interviewed managers in the steel industry reported that it is done by

Table 5
The difference of customer knowledge sources of the steel and the textile industries

Factor value	The steel industry (n=40) Significant		The textile industry (n=47)		F	P-	difference
	Mean	Standard deviation	Mean	Standard deviation			
Market information	5.631	0.802	4.675	1.255	17.187	0.000	***Yes
Customer information	5.668	0.707	5.101	0.998	9.071	0.003	**Yes
Order information	5.681	0.657	5.393	1.140	1.981	0.163	No
Product and service information	5.555	0.718	5.425	1.216	0.322	0.572	No
Customer complaint information	5.700	0.857	5.164	1.410	4.376	0.039	*Yes
Best practice information	5.841	0.683	5.418	1.246	3.669	0.059	No
*P < 0.05; **P < 0.01; ***P < 0.001.							

Themanagers of departments and they alone decide what is needed. The crucial point is whether or not new knowledge and information can be captured. Concerning the factor Fknowledge storage, the interviewed employees in the steel industry indicated that data should be effectively integrated and managed while the interviewed employees in the textile industry did not feel this would help much. Concerning the factor Fknowledge sharing, the interviewed employees in both industries indicated that delegated teams should be set up and theseteam members should be responsible for teaching others. Besides, regarding mutual knowledge sharing among employees, those interviewed in the steel industry indicated that they accepted this way of knowledge sharing while those interviewed in the textile industry did not. Concerning the factors of Fknowledge application and Fknowledge creation, the interviewed employees in the steel industry reported that it is good to apply and create knowledge and that the application of knowledge by employees to their tasks can create better knowledge, while those interviewed in the textile industry did not think this.

Table 6
The difference of customer knowledge management between the steel and the textile industries

Factor value	The steel industry (n=40) Significant		The textile industry (n=47)		F	P-	difference
	Mean	Standarddeviation	Mean	Standarddeviation			
Knowledge capture	4.831	0.974	3.968	1.152	13.946	0.000	***Yes
Knowledge storage	4.908	1.101	4.255	1.210	6.853	0.011	*Yes
Knowledge sharing	4.887	1.034	4.287	1.466	4.707	0.033	*Yes
Knowledge application	5.183	0.747	4.098	1.034	30.413	0.000	***Yes
Knowledge creation	5.033	0.917	4.276	1.119	11.649	0.001	**Yes

*P < 0.05; **P < 0.01; ***P < 0.001

- • The differences in customer knowledge performance measurement between the steel and the textile industries

As shown below in Table 7, in the dimension of customer knowledge performance measurement, the expressed importance of the factor Fsoft knowledge performance measurement is significantly different between the steel and the textile industries. In particular, the steel industry puts more emphasis on departmental knowledge sharing enhancing the loyalty of employees to their company than the textile industry. However, employees in both industries reported that this factor does contribute positively to their companies. The expressed importance of the factor Fhard knowledge performance measurement is not significantly different between these two industries. Employees in both industries reported that customer knowledge management can lower their costs, increase customer purchase rate, save inventory cost and make a tangible contribution to their companies.

As shown in Table 8, respondents in the steel industry reported that good customer knowledge management is goodsfor customer retention, repeat purchases and market share in the hard measures. Respondents in the textile industry reported that good customer knowledge is good for cost savings, customer retention and market share in the hard measures. Concerning the soft measures, respondents in the steel industry reported that good customer knowledge management is beneficial to customer satisfaction, customer loyalty and market leadership. Respondents in the textile industry reported that good customer knowledge management is beneficial to customer satisfaction, customer loyalty and customer and employee productivity.

Table 7
The difference of customer knowledge performance measurement between the steel and the textile industries

Factor (n=47) F P	The steel industry (n=40)		Thetextile industry				
	Mean	Standarddeviation	Mean	Standarddeviation	Diff.		
Hard knowledge performance measurement	5.387	0.544	5.403	1.040	0.008	0.930	No
Soft knowledge performance measurement	5.628	0.667	5.227	1.002	4.637	0.034	*Yes
*P < 0.05.							

Table 8
Customer knowledge management hard and soft measure

Hard measures	Mean (steel industry)	Mean (textile industry)	Soft measures	Mean (steel industry)	Mean (textileindustry)
Cost savings	5.53	*5.60	Customer satisfaction	*5.85	*5.45
Customer retention	*5.85	*5.64	Customer loyalty	*5.70	*5.32
Repeat purchases	*5.88	5.47	Customer and employee productivity	5.50	*5.32
Market share	*5.93	*5.55	Employee loyalty	5.40	4.77
Customer acquisition rate	3.15	5.45	Market leadership	*5.78	*5.36
Cost of sales/expense reduction	5.43	5.30	Organizational stability	5.63	5.23
Stock valuation	5.65	5.13	Cultural change	5.55	5.15
Profit margins	5.68	5.09			
*Importance.					

Analysis of regression

The regression model formulated is shown below:
The steel industry:
M1: Hard knowledge performance measurement =
$a1+b11*A1+b12*A2+b13*A3+b14*A4+b15*A5+b16*A6+e1$
M2: Soft knowledge performance measurement =
$a2+b21*A1+b22*A2+b23*A3+b24*A4+b25*A5+b26*A6+e2$

M3: Hard knowledge performance measurement
$=a3+b31*B1+b32*B2+b33*B3+b34*B4+b35*B5+e3$

M4: Soft knowledge performance measurement =
$a4+b41*B1+b42*B2+b43*B3+b44*B4+b45*B5+e4$
The textile industry:

M5:Hardknowledge performance measurement =
$a5+b51*A1+b52*A2+b53*A3+b54*A4+b55*A5+b56*A6+e5$

M6: Soft knowledge performance measurement =
$a6+b61*A1+b62*A2+b63*A3+b64*A4+b65*A5+b66*A6+e6$
M7: Hard knowledge performance measurement =
$a7+b71*B1+b72*B2+b73*B3+b74*B4+b75*B5+e7$
M8: Soft knowledge performance measurement =
$a8+b81*B1+b82*B2+b83*B3+b84*B4+b85*B5+e8$

Where
A1: Market information   B1: Knowledge capture
A2: Customer information   B2: Knowledge storage
A3: Order information   B3: Knowledge sharing
A4: Product and service information   B4: Knowledge application
A5: Customer complaint information   B5: Knowledge creation
A6: Best practice information
ai: Intercept   bij: Slope   ei: Error

The regression analysis of the effects of the dimensions of customer knowledge sources and ustomer knowledge management on the dimension of customer knowledge performance measurement is described below.

- The analysis of regression of the effects of customer knowledge sources on customer knowledge performance measurement in the steel industry

As shown in Models M1, M2, M3 and M4 in Table 9, in the steel industry customer knowledge sources and customer knowledge management show significant differences in the factors: hard knowledge performance measurement and soft knowledge performance measurement (M1: F = 27.468, P = 0.000; M2: F = 19.382, P = 0.000; M3: F = 5.802, P = 0.021; M4: F = 8.925 P = 0.005).
Table 9
The analysis of regression of the effects of customer knowledge and management on hard and soft knowledge performance measurement in the steel industry.

According to the statistical outcome in the dimension of customer knowledge sources, the factors of product and service information and best practice information directly affect the factor of hard and soft knowledge performance measurement. In the dimension of customer knowledge management, the factors of knowledge application directly affect the factor of hard and soft knowledge performance measurement. Therefore, respondents in the steel industry reported that to provide product and service information for customers and to share internally the best practice information (especially through knowledge application) can have benefits for hard measures such as market share, repeat purchases, and customer retention and soft measures such as customer satisfaction, market leadership and customer loyalty.

- The regression analysis of the effects of customer knowledge sources on customer knowledge performance measurement in the textile industry

As shown in Models M5, M6, M7 and M8 in Table 10, in the textile industry customer knowledge sources and management show a significant difference in the factor of soft knowledge performance measurement (M5: $F = 109.166$, $P = 0.000$; M6: $F = 25.811$, $P = 0.000$; M7: $F = 8.217$, $P = 0.006$; M8: $F = 6.587$, $P = 0.014$). In the dimension of customer knowledge sources, the factors of best practice information directly affect hard knowledge performance measurement. On soft knowledge performance measurement, the factors of customer complaint information and best practice information have direct influence. In the dimension of customer knowledge management, the factors of knowledge storage directly affect hard and soft knowledge performance measurem

Table 10

The analysis of regression of the effects of customer knowledge sources and management on hard and soft knowledge performance measurement in the textile industry

Model		M_1	M_2	M_3	M_4
		Hard knowledge performance measurement	Soft knowledge performance measurement	Hard knowledge performance measurement	Soft knowledge performance measurement
Customer knowledge Sources	Market Information Customer information Order information Product and service information Customer complaint Information Best practice Information	0.283* 0.566***	0.327* 0.464**		
Customer Knowledge management	Knowledge Capture Knowledge Storage Knowledge Sharing Knowledge Application Knowledge creation				
R^2		0.599	0.512	0.132	0.190
F Value		27.468	19.382	5.802	8.925
P Value		0.000***	0.000***	0.021*	0.005**
*P<0.05; **P<0.01; ***P<0.001					

Thus, respondents in the textile industry report that to provide customer complaint information for customers and to share internally the best practice information (especially through knowledge storage) can have benefits on hard measures such as customer retention, cost savings, and market share and soft measures such as customer satisfaction, market leadership customer loyalty, and customer and employee productivity.

Discussion

As mentioned above, the objectives of the paper are to present the proposed KCRM model which facilitates the exploration of the relationship among the three dimensions of customer knowledge sources, customer knowledge management and customer knowledge performance measurement; to conduct a comparative study of the case companies in the steel and textile industries in terms of the presented model; and to show the way in which the presented model can facilitate the identification of factors that have important impacts on business performance.The findings shown above, as reported by respondents in the case companies, demonstrated the kinds of customer knowledge sources they really need, how knowledge management can help them collect the needed customer knowledge sources and the way in which knowledge management can help them manage customer relationship in terms of Tiwana's (2000) customer knowledge performance measurements. Since many academic researchers try to connect the concept between KM and CRM, this research puts the proposed KCRM into application. So the proposed KCRM model can even be fitted to other companies to solve these problems.

The comparative study of the case companies in the steel and textile industries in terms of the presented model was also performed by ANOVA. The result has shown that different companies have different requirements. Basically, this could help different companies to identify their own requirements and further

Model		M_1	M_2	M_3	M_4
		Hard knowledge performance measurement	Soft knowledge performance measurement	Hard knowledge performance measurement	Soft knowledge performance measurement
Customer knowledge Sources	Market Information Customer information Order information Product and service information Customer complaint Information Best practice Information	0.0.841***	0.385* 0.397*		
Customer Knowledge management	Knowledge Capture Knowledge Storage Knowledge Sharing Knowledge Application Knowledge creation			0.393**	0.357*
R^2		0.708	0.540	0.154	0.128
F Value		109.166	25.811	8.217	6.587
P Value		0.000***	0.000***	0.006**	0.014*
*P<0.05; **P<0.01; ***P<0.001					

have their own directions.

To show how the presented model can facilitate the identification of the factors having the most impact on business performance, regression analysis was used. Each company has its reason or expectation to know why KM can improve CRM. Moreover, the hard and soft knowledge performance measurements are key performance indicators and could be further achieved through complete customer knowledge sources and customer knowledge management. The results have shown that respondents in the different company indicate that to provide different knowledge sources (especially through different customer knowledge anagement) can have benefits on different hard and soft knowledge performance measurements. Facing up other companies, the proposed KCRM model can help to give directions to achieve key performance

indicators. Our findings suggest a number of directions for future research. The proposed KCRM model is used on our on-going project for one leading beauty industry both in Taiwan and China. There are two questions raised within this project: How the IT solution could be revised to satisfy KCRM model? How to overcome the difference between different countries (Taiwan and China)? Finally, the proposed KCRM model may be applicable to both KM and CRM areas. Therefore, additional research might investigate our contingency model in other domains, involving Collaborative Marketing and Integrated Marketing Communications, and other types of industries.

Conclusion

Using the steel and textile industries as examples, this study has revealed how KM can improve CRM. The proposed KCRM model has been presented which addresses the relationship among the three dimensions of customer knowledge sources, customer knowledge man- agement and customer knowledge performance measure- ment and identifies the important factors that have key impacts on business performance in particular settings. The importance of KCRM is thus established, and it is suggested that in the future KM-enabled CRM will be more widely implemented.

References

1. Alajoutsijärvi,K.,Klint,M.B.,&Tikkanen,H.(2001). Customer relationship strategies and the smoothing of industry specific business cycles. Industrial Marketing Management,30(6),487–497.

2. Armbrecht,F.M.,Richard,B.,Chapas,R.B.,Chappelow,C.C.,Farris,G. F., Friga, P.N., et al. (2001). Knowledge management in researchand development. Research Technology Management, 44(4), 28–48.Arthur Andersen Business Consulting. (1999).Knowledge management:Jissennotamenobestpractice.TokyoToyoKeizai.

3. Avlonitis, G. J., &Gounaris, S. P. (1997). Marketing orientation and company performance. Industrial Marketing Management, 26(5), 385–402.

4. Bauer, H. H., Grether, M., & Leach, M. (2002). Building customer relations over the Internet. Industrial Marketing Management, 31(2), 155–163.

5. Beckman, T. (1997). A methodology for knowledge management.Proceedings of the IASTED international conference on AI and soft computing.Broadvision Consulting. (2000, July). Essence of one to one relationshipmanagement. E-Business executive's report, 15, 11 – 15.

6. Brown,S.A.(2000). A case study on CRM and Mass Customization. InS. A. Brown (Ed.), Customer relationship management—a strategic imperative in the world of e-business.Toronto'John Wiley and Sons Canada.

7. Curry,J.,&Curry,A.(2000).Thecustomermarketingmethod.NewYork'The Free Press.

8. Cole, J., & Goldsmith, C. (1997, April). Rivalry between Boeing, Airbus takes new direction. Wall Street Journal, B4.

9. Davenport, T.H., Delong, D. W., & Beers, M. C. (1998). Successful knowledge management projects. Sloan Management Review, 39(2), 43–57.

10. Handen, L. (2000). The three Ws of technology. In S.A. Brown (Ed.), Customer relationship management—a strategic imperative in the world of e-business. Toronto'John Wiley and Sons Canada.

11. Korner, V., &Zimmmermann, H. D. (2000). Management of customer relationship in business media. The case of the financial industry.

12. Proceedings of the 33rd Hawaii International Conference on System Sciences (pp. 1 – 10).

13. Leonard, D., &Sensiper, S. (1998). The role of tacit knowledge in groupinnovation. California Management Review, 40(3), 112 – 132.

14. Lesser, E., Mundel, D., &Wiecha, C. (2000, November/Decem- ber). Managing customer knowledge. Journal of Business Strategy, 21, 35– 37.

15. Lin, Y. (2000/2001). Assessing the applicabilityof integrated communications A systemic view. Journal of Integrated Communica- tions, 46– 51.

16. Lin, Y., & Su, H. (2003). Strategic analysis of customer relationship management—a field study on hotel enterprises. Total Quality Management and Business Excellence, 14(6), 715 – 731.

17. Massey, A. P., Montoyaweiss, M. M., &Holcom, K. (2001). Re- engineering the customer relationship: Leveraging knowledge assets at IBM. Decision Support Systems, 32(2), 155 – 170.

18. O'Dell, C., & Grayson, C. J. (1998). If only we knew what we know: Identification and transfer of internal best practices. California Manage- ment Review, 40(3), 154 – 174